PROGRAM

10th Technical Symposium

CO-SPONSORED BY

U.S. Air Force Systems Command

16-20 AUGUST 1965

JACK TAR HOTEL • SAN FRANCISCO

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REGISTRATION

All who attend the Symposium & Exhiborama of Instruments must register and receive an official badge.

Registration will be on the mezzanine floor. Speakers will register in the Embarcadero Room.

INFORMATION & MESSAGE CENTER

A general information and message center will be maintained during the Symposium. The telephone number to leave with your office is:

Area 415/771-1630

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WELCOME - - - -

The Society of Photo-optical Instrumentation Engineers extends a sincere welcome to the many representatives of Industry, Government and the Military services who join in this, the 10th Annual Technical Symposium devoted to photo-optical data acquisition, storage, retrieval and assessment.

This meeting is the culmination of very nearly a year of careful planning on the part of a dedicated committee. The success of their efforts is found in the strength of the program listed on the pages of this booklet. We can repay them by listening with critical objectivity, participating freely in the open question periods, challenging authority, insisting on specifics and taking the most advantage of that invaluable person-to-person exchange of information which has come to be a Symposium tradition.

A product display, Exhiborama of Instruments, has been provided so you may have an opportunity to discuss equipment and services with highly qualified Technical Representatives and Applications Engineers. Exhibit hours are arranged so you will have ample time.

Finally, I can speak for the members of SPIE, the officers of the society, and the Symposium Committees and tell you we are honored and pleased that you have come.

Raymond F. Grant
SPIE National President

15 August 1965
San Francisco, California

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National Symposia Vice-president
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* * *

Audio-visual services for the Symposium provided by

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ACKNOWLEDGEMENT - - - -

The 10th Technical Symposium Committees express deep appreciation for the generous support of NASA, the Air Force, Army and the Navy. Our technical program is testimony to the cooperative spirit of our government agencies and the military services which encourage rapid technical information exchange among members of our scientific and technical community.

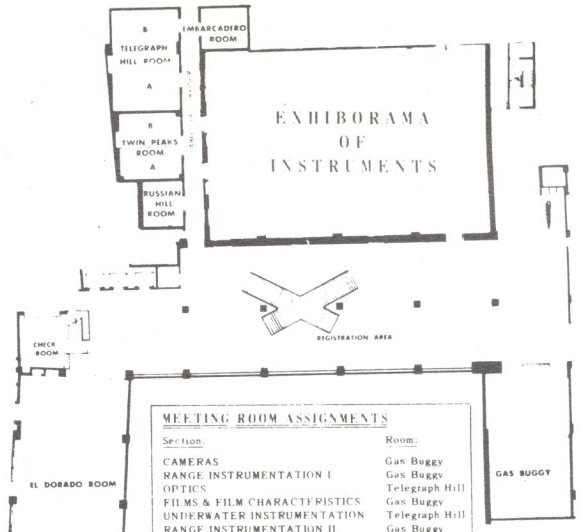
There are many public information displays to point up the extent to which photo-optical instrumentation engineering supports our defense and aero-space efforts. They are a source of pride to all of us who contribute to this work. They also serve to remind us of our personal professional responsibility to keep pace with the technological requirements of our national destiny. In this way they typify the spirit of our Symposium.

We express special thanks to the U.S. Air Force Systems Command for its official co-sponsorship. We hope our efforts have justified their confidence.

B. G. Ponseggi
Vice President, SPIE Symposia

The SOCIETY of PHOTO-OPTICAL INSTRUMENTATION ENGINEERS

10th Annual Technical Symposium
&
Exhiborama of Instruments
16 - 20 August 1965
Jack Tar Hotel, San Francisco



MEETING ROOM ASSIGNMENTS

Section:	Room:
CAMERAS	Gas Buggy
RANGE INSTRUMENTATION I	Gas Buggy
OPTICS	Telegraph Hill
FILMS & FILM CHARACTERISTICS	Gas Buggy
UNDERWATER INSTRUMENTATION	Telegraph Hill
RANGE INSTRUMENTATION II	Gas Buggy
PHOTO OPTICS AT WORK IN RESEARCH & INDUSTRY	Telegraph Hill
AWARDS LUNCHEON	El Dorado
ADVANCES IN TECHNOLOGY	Gas Buggy
EDUCATION	Telegraph Hill
IMAGE PROCESSING	Gas Buggy
STANDARDS	Telegraph Hill
LASERS	Gas Buggy
FILM PROCESSING	Telegraph Hill
DATA REDUCTION	Gas Buggy
MARKETS & MANAGEMENT	Telegraph Hill
AEROSPACE INSTRUMENTATION	Gas Buggy

Special Meetings: SPIE Corporation - Sunday 15 August 7:00 P.M., in Garden Room, 4th Floor
SPIE Board of Governors, 15 August 8:30 P.M., Twin Peaks Room
Ladies Tea, Monday 16 August, 3:00 P.M., Twin Peaks Room
Ladies Continental Breakfast, 17 August, 9:00 A.M. Twin Peaks Room

10th ANNUAL TECHNICAL SYMPOSIUM

MONDAY MORNING
Registration & Workshop Sessions

OFFICIAL OPENING

12:30 - 2:00 SYMPOSIUM KEYNOTE LUNCHEON

Guest of Honor and Principal Speaker:
Brigadier General Joseph S. Bleymaier,
Deputy Commander, Manned Systems,
Space Systems Division, USAFSC
"CHALLENGES FOR TOMORROW"

2:30 — GRAND OPENING EQUIPMENT EXHIBITS

3:00 - 6:00
CAMERAS GAS BUGGY ROOM

Chairman: Bernard Marcus, Mark Systems Inc.

DESIGN PARAMETERS OF AN ASTRONOMICAL CAMERA FOR LUNAR CHARTING
Kenneth T. Sime, Chief, Cartography Division
Aeronautical Chart & Information Center

With the advent of Ranger probes and more advanced reconnaissance systems, telescopic photography will continue to play a significant role in the study of the lunar surface during the next few years. A new astronomical camera has been designed and fabricated in support of the Air Force lunar charting program at ACIC, and the features incorporated into this design make it one of the most accurate photographic tools ever used in the field of astronomy.

LIGHT SOURCES FOR CAMERA TIMING MARKERS

Robt. E. Hiller and **Dr. LeRoy M. Dearing,** L-M Dearing Associates

Highly efficient and compact timing marker light sources have been recently developed. One is a spark source which requires no optics, the other is a neon lamp, plus efficient lens system, to put intense timing marks on the edge of motion picture films. These sources can be packaged into camera timing blocks to fit most rotary prism and framing motion picture cameras at both high and medium speeds. Details of their development are discussed in this presentation.

STRIP COPY CAMERA

R. O. Buckingham, Chicago Aerial Industries

A special arrangement of a five inch aerial strip camera permits its use as a copy camera for producing high quality color films with close tolerances of magnification in both X and Y directions. The performance of this camera demonstrates an unusual dynamic performance which could not normally be expected of the camera mounted in an airborne vehicle. Pan-X resolution exceeds 75 lines per mm at 6.69:1 reduction when copying opaque USAF 1951 targets. Color resolution at the same reduction exceeds 35 lines per mm on Ektachrome MS film.

AN AUTOMATIC EXPOSURE CONTROL AND SHUTTER SYNCHRONIZER SYSTEM

Nathaniel L. Sims, Fairchild Space and Defense Systems, Div. of Fairchild Camera

Modern mapping camera technology requires the integration of several component subsystems to meet the high performance standards required for precision mapping photogrammetric methods. This paper is devoted to the discussion of an automatic exposure control servo system that, in conjunction with a digitally controlled shutter synchronizer system, provides constant density exposures over a terrain brightness range of 50 to 4,000 ft. lamberts for films with an ASA index range from 20 to 2,000. The wide range of control is obtained by controlling both the exposure time, via a between-the-lens shutter, and an iris diaphram.

TWO PHOTOGRAPHIC CAMERAS OF ADVANCED DESIGN FOR THE APOLLO TEST MISSION

E. W. Templin, D. B. Milliken Co.

Progressive steps in the Space Program are calling for significant estensions in reliability and environmental performance of the supporting photo-optical instrumentation systems. Two advanced model cameras are described which are being used in various phases of the Apollo test program. Each type is pressure sealed to protect the film in flight as well as after subsequent water immersion.

INTERMITTENT FILM MOVEMENTS

Walter Renold, Consulting Engineer

Problems faced in designing intermittent camera and projector film movements are outlined and compared, considering a wide range of camera applications, from 8mm to 70mm format, and from time lapse to 600 frames per sec. speed. Best solutions developed in the industry are presented, and novel approaches are discussed.

8:00 – INTER-SOCIETY SESSION

EADWEARD MUYBRIDGE PHOTOGRAPHS THE HORSE IN MOTION

RALPH W. HANSEN
Curator of the Stanford Collection
Stanford University, Palo Alto

An informal presentation which shows how millionaire railroad-builder Leland Stanford's efforts to prove that at one point in a horse's gait, all four feet are off the ground, contributed to the development of motion pictures.

This pioneering photo-instrumentation work (done in 1877!) is still regarded as a classic motion study.

Some of Muybridge's original glass plates and equipment will be used to illustrate this interesting presentation.

(concurrent with OPTICS session)

TUESDAY - 9:00 - 12:00 GAS BUGGY ROOM

RANGE INSTRUMENTATION

Chairman: William Pabst, Jr., WSMR

THE AIRBORNE LIGHTWEIGHT OPTICAL TRACKING SYSTEM (ALOTS)

Robert L. Rodgers, Northrop/Nortronics

The Airborne Lightweight Optical Tracking System (ALOTS), currently under development for the Air Force Eastern Test Range by the Nortronics Division of Northrop Corp., will be discussed. It explains the combination of both manual and automatic tracking systems to be installed in a C-135 aircraft. Primary advantages of ALOTS over ground based systems currently used for photographic tracking and its ability to perform under almost any weather condition is discussed. Operation at an altitude of approximately 40,000 ft. in 75 percent of the earth's atmosphere will virtually eliminate interference from clouds and other atmospheric conditions.

PROBLEMS PECULIAR TO SPECTRAL BALLISTIC CAMERA INSTRUMENTATION

Daniel J. Novak, Dynalectron Corp.

The Spectral Ballistic Camera instrument (slitless spectrographs for nighttime use) provide relative intensity data as a function of wavelength, and scintillation analysis information on various missiles and other emissive body trajectories. Problems encountered when recording low-light-level emissions, calibration of off-axis imagery, optimum recording emulsions, development techniques, reduction of data, and timing correlations are currently being investigated.

The instruments are presently confined to recording trajectory and spectra on relatively wide-field cameras that are directed toward the areas of interest. Transmission gratings mounted before the lens are aligned on the cameras so that the direction of spectral dispersion is perpendicular to the predicted motion on the trajectory.

ADVANCED TRACKING INSTRUMENTATION FOR OPTICAL COMMUNICATIONS R & D PROGRAMS

Walter Carrion, Goddard Space Flight Center

To support the laser communication research and development programs, new optical tracking instrumentation has been developed.

This paper describes the Real Time Automatic Digital Optical Tracker (RADOT), field experiments and field evaluations of the system. RADOT employs a program drive, controlled by a special purpose computer to aid in the acquisition of space probes and satellites. The system will automatically track satellites to precisely point laser transmitters and receivers.

A HIGH DISPERSION TELESPECTROGRAPH

Allen Langord, Fecker Division, American Optical Co.

A Tracking Telespectrograph System incorporating a large aperture, precision optical instrument and a cable driven, ball-bearing mount used to track the reentry flight of a space vehicle or satellite is discussed. It also records on film and magnetic tape a continuous spectrum of its light-output and supplementary sequential engineering data with respect to real time. This instrument is presently based on Ascension Island.

NOTE: Range Instrumentation sessions continue Wednesday morning.

9:00 - 12:00 *(concurrent with RANGE session)*

OPTICS

Chairman: **Dr. Robert Potter,** IBM Research

LENS DESIGN REQUIREMENTS FOR THE APOLLO COMMAND MODULE TV CAMERA

Ralph Jordan, Astro Electronics, RCA

This paper will discuss the optics for the TV camera to be used in the Apollo command module. There will be a brief discussion of mission requirements. The mission necessitates the use of interchangeable optics. A detail discussion of the optical, mechanical, environmental and human engineering considerations in the design of the lens will constitute the main portion of the paper. The balance will be devoted to the testing and image evaluation program for the lenses. Special attention will be given to unusual problems and how they were solved. The design considerations for the Apollo TV Camera and the optics are based on experience in design participation of similar space qualified systems like the Tiros and Ranger satellites as well as cameras for the OAO and Nimbus satellites.

EFFECT OF LIGHT FILTERING ON THE OPTICAL TRANSFER FUNCTION

R. R. Shannon, Itek Corp.

There has been considerable investigation of the Optical Transfer Function for monochromatic imagery. For an actual photographic system an extended spectral region must always be considered. A computation technique has been developed in which the individual transfer functions for several wavelengths are combined to produce an over-all white light transfer function for a lens under various light filtering and emulsion spectral sensitivity conditions.

The use of this technique in optical design is shown by the balancing of spherochromatism against axial color. Finally, some examples of specific lenses are also shown along with experimental confirmation of the theory.

PHOTO-OPTICAL SYSTEMS SIMULATION

Dr. Dieter P. Paris, IBM-San Jose

In order to make efficient use of a digital computer, it is advisable to have special purpose high level languages available. Such languages should allow the engineer to state his problem in a simple manner, preferably closely related to the English language. IBM has developed such a special purpose language, which is applicable to the simulation of photo-optical image forming systems. The language allows to simulate one-dimensional image formation by a single or multiple stage system.

The use of the language allows to study the performance of photo-optical systems already in the design stage, before the hardware is available. It may be used to optimize component parameters or to study tolerances.

A THEORETICAL AND EXPERIMENTAL METHOD OF EVALUATING THE MODULATION TRANSFER FUNCTION OF LENSES

J. S. Wilczynski and **H. Hurd,** IBM Research

The Modulation Transfer Function (MTF) of a lens is now a widely accepted measure of lens performances. A suitable study was undertaken at the T. J. Watson Research Center. The approach to both the theoretical and experimental evaluation is discussed in this presentation.

session continues next page

HOLOGRAMS - THEIR PROPERTIES AND USES

Dr. Emmett N. Leith and **J. Upatnieks**
Institute of Science & Technology, University of Michigan

Since the recent demonstrations of high-quality three-dimensional imagery, possible uses for this technique have been explored. In addition, many other long-proposed applications are being reexamined. The proposed applications cover a wide range, from x-ray microscopy to communication transmission and from interferometry to reconnaissance. This paper will summarize these applications and comment on their attainability. Experimental results of recent work will be presented.

FIBER OPTICS IN PHOTOGRAPHY

Dr. Narinder S. Kapany, Optics Technology, Inc.

Fiber optics field flatteners and image dissectors have found applications in high resolution photographic systems. Furthermore, fiber assemblies in the form of Focons have been used in photographic systems capable of high resolution over wide angles and low f-ratios. Design considerations as well as performance characteristics of wide angle photographic systems incorporating Focons will be discussed. Modulation transfer function, vignetting and T-number data in these systems will be presented.

1:30 - 5:00 *(concurrent with FILMS session)*

UNDERWATER INSTRUMENTATION

Chairman: **Paul J. Kruse, Jr.,** U.S. Fish and Wildlife

CORRELATION OF UNDERWATER PHOTOGRAPHIC RESULTS WITH WATER CONDITIONS

Robert O. Briggs, Oceanographic Eng. Corp.

This paper discusses the techniques for extending visibility range with artificial imaging systems and presents analytical and empirical data correlating the range of underwater visibility (using the human eye and an optimized artificial imaging system) with transmissability measurements using an OEC one meter transmissometer. Results of the analysis and empirical studies are summarized on a nomograph chart.

UNDERWATER CAMERA CALIBRATOR

Gomer T. McNeil, Photogrammetry, Inc.

The Underwater Camera Calibrator is a precision instrument that provides a known angular array of collimator targets to be photographed by a camera under test. The images of the targets are then read and measured to yield the necessary data for the determination of focal length, location of principal point, distortion and resolution.

UNDERWATER LIGHT ATTENUATION MEASUREMENTS

Floyd Kinder, USN, NOTS, China Lake

Light attenuation measurement techniques will be discussed and typical data presented. Measurements taken near San Clemente Island will be presented of the volume attenuation coefficient, diffuse attenuation coefficient, and spectrographic characteristics. Typical volume attenuation measurements taken in the north Pacific at depths to 6000 ft. will also be presented.

OCEAN BOTTOM PHOTOGRAPHY FROM A DEEP TOWED CAMERA SYSTEM

Walter L. Brundage, Jr., and **R. B. Patterson,** U. S. Naval Research Laboratory

A towed deep ocean photographic system in continuous use and development at the U. S. Naval Research Laboratory has produced well over 100,000 bottom photographs. Details of this system, including the arrangement of lights and cameras, the use of longer ranged sensors to regulate camera operation, and the shipboard processing techniques, are described. Some proposed future improvements in the system are also presented.

Cmdr. F. R. Haselton, United States Navy
Deep Submergence Systems Project

The DSSP is a new Navy program designed to provide not only the Navy, but also the nation, with a vastly increased capability in the deep oceans. Its impetus was set by the disastrous loss of the Thresher bringing into sharp focus our inadequacies in this realm of the world. This effort is basically divided into four major areas which include; submarine rescue; man-in-the-sea; deep ocean small object search and retrieve; salvage. The Navy's interest in sensors in the ocean has heretofore been predominately focused on the field of acoustics because of the interest in the long range propagation characteristics of the sea. Now we are faced with the very real problem of maneuvering highly sophisticated and complicated manned vehicles at very low speeds and in proximity to the bottom and to other object thereon. This requires, and will continue to require, heavy emphasis in the visual and photo-optical techniques.

1:30 - 5:00 *(concurrent with UNDERWATER session)*

FILMS AND FILM CHARACTERISTICS

Chairman: **Sheldon Phillips,** Eastman Kodak, Special Sensitized Products Division

EFFECT OF SENSITOMETRIC RESPONSE ON THE GEOMETRIC CHARACTERISTICS OF PHOTOGRAPHICALLY RECORDED DIGITAL DATA

Dr. William A. Miller, Fairchild-Hiller, Inc.

Continued improvement in the performance both brightness and diameter control of the spot of the annotator(CRT) has made precision under-exposure unnecessary in order to maintain the proper dot-geometry on the negative.

The requirement that not only the negative, but also the positive, be machine-readable has required a reconsideration of the analytical expression for the density-exposure characteristics of various films. A new model of this characteristic is presented. This model is accurate from very low densities to densities well above the point of inflection, and has been used to calculate exposure times, maximum density attainable, and dot-profiles with accuracy sufficient for annotator systems engineering purposes.

A STABILITY STUDY OF PHOTOGRAPHIC LATENT IMAGES

Gary Micanek, McDonnell Aircraft Corp.

A study into the stability of the photographic latent image is presented. Four factors have been investigated -- time, temperature, humidity, and spectral sensitization of the emulsion. It is found that the effective speed of the emulsion passes through a maximum and then begins a rapid decrease when the material is stored at elevated temperatures. This study shows humidity and sensitization to be less in magnitude than temperature in producing changes in the latent image when all are a function of time.

THE MEANING OF NUMBERS APPLIED TO PHOTOGRAPHIC PARAMETERS

Daan M. Zwick, Eastman Kodak Laboratories

The purpose of much of the work of the photographic instrumentation engineer is to reduce phenomena to numbers, so he can measure, analyze and manipulate. The purpose of this presentation is to help the engineer, and others less technically trained to understand what numbers can be assigned to characteristics of photographic materials, and what worth such numbers can have. Numbers discussed are those associated with sensitometry (speed, contrast, gamma, latitude) but most especially those associated with image structure (RMS granularity, and modulation transfer function). Both color and black-and-white films are considered.

AN EVALUATION OF NEW MAXIMUM SPEED FILM/DEVELOPER COMBINATION

William T. Jordan, Lawrence Radiation Lab.

A new film-developer combination from Eastman Kodak, designed for maximum speed, has been tested for application in the scientific recording field. The results of sensitometric and empirical tests indicate a several-fold gain in sensitivity over all other emulsions tested to date. Increases in cathode ray oscilloscope writing speeds have been made possible with conventional recording cameras along with the amplification of recording sensitivity of high speed camera systems.

DATA DISSEMINATION DILEMMA

Panelists:

A. C. Peed, Eastman Kodak Company
Dr. F. Gerhardt, General Aniline & Film Co.
Dr. H. W. Knop, Jr., Dr Pont
C. S. McCamy, National Bureau of Standards

8:00 - UNDERWATER DEMONSTRATION IN POOL

(concurrent with RESEARCH & INDUSTRY session)

WEDNESDAY - 9:00 - 12:00

RANGE INSTRUMENTATION II GAS BUGGY ROOM

Chairman: Wm. Pabst, Jr., WSMR

OPTICAL INSTRUMENTATION FOR RE-ENTRY STUDIES

Dan Parsons, Sandia Corp.

Several types of optical instrumentation, both tracking and fixed axis, ground and airborne, were developed to prove disassembly of an inert nuclear power supply carried on the nose of a reentry vehicle and to record the heating and ablation of inert fuel rods ejected from the vehicle early in the reentry phase of the trajectory. Instrumentation that will be discussed includes several varieties of spectrographs, sampling photometers, plate cameras, streak cameras, event cameras and tracking mounts. Results obtained by all types of instrumentation will be discussed including the correlation between telemetry and optical data.

ACCURACY EVALUATION PLAN FOR CINETHEODOLITES, PARTICULARLY THE WSMR SUPER CINETHEODOLITE

William Pabst, Jr., WSMR Instrumentation Directorate

The WSMR Cinetheodolite instrument geometry is defined optically and not defined by the mechanical structure as in conventional cinetheodolites. It is expected that this principal will permit instrumental accuracies of 2-5 sec. for dynamic recordings. Maintaining instrumental accuracies of this precision requires that the contributing terms of the theodolite error equation be limited to the 1/4 - 1/2 sec. measurement region. A discussion of test methods and procedures will be given.

session continues next page

A NEW PHOTO-OPTICAL TRACKING SYSTEM USING THE CINE-SEXTANT TRACKING MOUNT

Wesley R. Lambert, Naval Missile Center, Point Mugu, Calif.

This paper describes a photo-optical system procured by the Photographic Department of the Naval Missile Center, Point Mugu, Calif. This instrumentation system is built around a new photo-optical tracking mount and provides a high degree of efficiency, versatility, accuracy and mobility. A preliminary evaluation of the mount and the related series of especially configured cameras, lenses and automatic focusing components, is discussed.

10:45 - 12:00

RANGE INSTRUMENTATION PANEL

Each member will give 10 minute discussion of present and future trends or problems. Panel will then discuss questions from the floor.

PLANNING, **William Russell, WSMR**
DEVELOPMENT, **John Clemente,** PMR
OPERATIONS, **Al Glei,** ETR/RCA
SPECIAL PROJECTS, **Dan Parsons,** ARC/Sandia

9:00 - 12:00 *(concurrent with RANGE session)*

PHOTO-OPTICS AT WORK IN RESEARCH AND INDUSTRY TELEGRAPH HILL ROOM

Chairman: **Robt. Kotula,** Photographic Engineering Company

HIGH SPEED MACROPHOTOGRAPHY USED IN SEMICONDUCTOR MANUFACTURING

Paul C. Pfeiffer, Texas Instruments, Inc.

Discussed are the methods used in photographing contaminate particles of less than .006" size inside transistors while subjected to various frequencies and vibrations. Observation of wire forming dies and electrode welding of header posts in automatic equipment and a suggested method of adapting a microscope into a camera taking lens.

AN INSTRUMENT FOR DETERMINING THE LENS SPECTRAL TRANSMITTANCE

Frank S. Winski, Richard M. Bobbe, Gary K. Starkweather, Xerox Corporation

A device utilizing second order narrow band interference filters is described with which the spectral transmittance of a compound lens can be quickly and accurately determined on a routine basis, by a relatively unskilled operator. As a tool for receiving inspection, this device provides accuracy and versatility with a minimum of maintenance.

CINEMICROGRAPHY IN CELL BIOLOGY

Arthur T. Brice, Phase Films, Inc.

An historical outline will be given on the development of theories of image formation in the microscope, particularly how to make transparent objects under the microscope visible to the eye or camera. Technical aspects of design will be discussed, as well as light sources, the microscope, the camera, film, and the application of such films for instruction and education in Microbiology. Slides of different instruments for cinemicrography will be shown, plus a new film.

OCULOMETRY

John Merchant, Honeywell Radiation Center

The human eye must be pointed very accurately at detail of interest if this detail is to be seen with maximum clarity. The physiological eye pointing servo is a vital, not incidental, part of human vision. The neuromuscular system that controls eye direction is very highly developed. It has been suggested that this neuromuscular system might be used, in certain appropriate cases, as a new means for man to control a man/machine system. That is, that the eye muscles be used in place of, or in addition to, conventional hand action. In this way man's capability for action in these high performance man/machine systems might be usefully extended.

HIGH SPEED PHOTOGRAPHY OF A WEAVING MACHINE

E. M. Watson, Consultant

High speed photography was applied in the redesign of the Sulzer weaving machine for the production of wire screening. High speed photography has been utilized in order to capture the complete process of the loom at a visible rate of speed. Ordinarily, the loom operates with shuttles moving across the warp at approximately 60 miles per hr., or 4 shuttle actions per sec. Through the use of high speed photography, the process could be illustrated at a rate of 1 mile per hr., so that the necessary modifications could be made. High speed photography was then used as a check to insure proper functioning of the mechanism.

STEREO TECHNIQUES IN RESEARCH AND TRAINING

Robert L. Minter, Kollsman Instrument Corp. Systems Management Division

This presentation briefly reviews stereo techniques and compares them with a new concept. Studies have been performed to determine if stereo perception can be improved through training with positive results. Findings have been made which indicate an inherent capability of the human to utilize each visual channel separately through training and mental control. Application of such devices will be discussed including pre-school optometry, visual capabilities screening, imagery interpretation, training, simulation and superposition of artificial data on the real world.

12:30 - 2:30 -- AWARDS LUNCHEON

Guest of Honor and Principal Speaker:
Amrom Katz, Rand Corporation

Presentation of:
Robert Gordon Memorial Award
Karl Fairbanks Memorial Awards
George Goddard Award
Annual SPIE Governor's Award

2:30 - 6:00 *(concurrent with EDUCATION session)*

ADVANCES IN TECHNOLOGY GAS BUGGY ROOM

Chairman: **Robert G. Wiley,**
Kine-X Engineering Corp.

HIGH-SPEED PHOTOGRAPHY AND DYNAMIC PHOTOELASTICITY

Dr. Paul D. Flynn, Pitman-Dunn Research Laboratories, Frankford Arsenal

The application of photoelasticity to dynamic stress analysis generally involves the use of high-speed photography. The specialized equipment and techniques which has been developed for studying stress wave propagation in two-dimensional photoelastic models of either low or high modulus materials under mechanical or explosive loads are reviewed briefly. Recent modifications and improvements in a dual-beam polariscope which projects simultaneous normal and oblique incidence stress patterns into one camera are described. The use of interference filters for monochromatic light, half-size camera stops for reduced exposures, and characteristic curves of various films under these conditions are reported. Dynamic stresses which were obtained photoelastically are compared with results obtained by means of strain gages.

A CAMERA SYSTEM FOR PHOTOGRAPHY IN THE NEAR ULTRAVIOLET

Arthur C. Titus, The Perkin-Elmer Corp.

A camera system designed to record energy from the near ultraviolet spectral region from 3,000 to 4,000 Angstroms is discussed. To provide versatility of application, the system incorporates a flat-field variation of the Maksutov lens, three different shutters, and roll or cut film magazines.

TRANSMISSION OF LIGHT THROUGH THE ATMOSPHERE, CONCERNING ATTENUATION AND TURBULENT EFFECTS

Dr. John H. Atkinson, Dr. Paul G. McManigal, Boyd G. Foster, John D. Pembrook, Aeronutronic Div., Philco Corporation

Measurements of atmospheric transmission have been made over a twenty mile path. Factors affecting image contrast and small angle resolution have been studied by photography of especially built targets, monitoring of white light sources, and monitoring of a diffraction limited gas-laser. Casual relationships between parameters will be discussed, particularly as they apply to photography. The effects of aperture, shutter speed, wavelength, and polarization will be discussed.

THE USE OF CHARACTERISTIC VECTORS IN PHOTO-OPTICAL ANALYSIS

Ronald J. LaVallee, McDonnell Aircraft Corp

Characteristic vector analysis provides a statistical method for describing a set of physical data. These mathematics are interesting because they tend to collapse the information into a compact, meaningful form; because they easily adapt to digital computer processing; because they have an inherent flexibility which allows their extension to a wide variety of physical problems. This paper reviews the basic logic of the technique, suggests an alternative computational procedure and outlines several areas in photo-optics where characteristic vector analysis may profitably be applied. Although qualitative aspects of the subject are the primary concern, some time will be devoted to an exposition of the operational mathematics.

MINIATURIZED COMPONENTS FOR EMI SUPPRESSION IN PHOTO OPTICAL CONTROL SYSTEMS

A. L. Albin and E. Busch, Fairchild Camera

Camera control systems, stabilized mounts, navigational computers and related photo-optical control systems can produce high levels of electro-magnetic interference from pulse circuits, switches and relays. In military applications such interference must be controlled carefully. This paper considers the problem in terms of current military specifications for measurement and acceptable limits. It covers methods of noise suppression and describes the development of a postage-stamp size resistance capacitance filter for high attenuation of conducted and radiated interference.

70mm STOP MOTION FLICKERLESS PROJECTOR

Geoff Williamson, L-W Photo, Inc.

Fundamentals of a motion picture projector with 2500 ft. capacity that will transport 2.34 in. of 70 mm film at a rate of 24 frames per second in both directions without rethreading the film. Additional capabilities being instant start and stop, positive single-frame advance, and automatic rates as low as 2 frames per second, all modes completely *flickerless*, illumination of 9,000 screen lumens provided by Xenon arc.

A HIGH RESOLUTION REAR PROJECTION SCREEN SYSTEM

William D. Schultz, Consolidated Systems Corp.

Development of a rear projection screen system for the magnified projection of high resolution film images is discussed. The system has three distinct advantages over conventional projection systems in that resolution at the screen is in the order of 250 lines per millimeter, emission from the screen is truly *Lambertian* making it possible to view the screen from any angle without loss of intensity, the resulting image contrast differences are singularly unaffected by ambient light.

2:30 - 6:00 *(concurrent with TECHNOLOGY session)*
EDUCATION TELEGRAPH HILL ROOM
Chairman: **Robert Lewis,**
Amelco Semiconductor Co.

A PROGRESS REPORT ON SPIE EDUCATIONAL ACTIVITIES

Herman C. Schepler, JPL, SPIE National Education Committee Chairman

Dr. Francis Gerhardt, General Aniline & Film

SPIE National Education Committee gives assistance whenever requested to colleges and universities desiring to establish courses in photo-optical science and engineering. The factors involved in making recommendations of this nature are listed and discussed. The items that require special consideration in the establishment of a two-year photo-optics program for junior colleges are detailed. A sample curriculum for a two-year program at Fullerton Junior College is given. Course descriptions as they might appear in college catalogs and recommendations for texts and references are suggested.

THE PHILOSOPHY AND FUTURE OF THE PHYSICAL OPTICS NOTEBOOK

Dr. Brian J. Thompson, Technical Operations Research

The motivation for publication of the *Physical Optics Notebook* will be discussed and some detailed comments will be made on the future content of the work. Some discussion will also be included on new courses in modern optics which are being taught with the same underlying teaching philosophy as that used in the *Physical Optics Notebook*.

ELECTRO PHOTO OPTICS AT FOOTHILL COLLEGE

Robert Lewis, Amelco Semiconductor Co.

A statistical summary of the development of a course in "electro-photo-optics" at Foothill College, Los Altos, California, is presented. Certain trends will be projected from this information.

THE PRECISION LENS GRINDING TRAINING PROGRAM

Glen R. Guldberg, Citrus College, Azusa, Calif.

This presentation is made to illustrate the training presently being accomplished at Citrus College. It is emphasized that these trainees are schooled in the grinding, polishing and testing of optics basic to a research and development situation. Some techniques of production are taught but not stressed. All theory and knowledge units are taught as an integral part of the total program.

A PROFESSIONAL LIBRARY FOR PHOTO-OPTICAL INSTRUMENTATION ENGINEERS

William P. Price, Aerojet General

A Photo-optical Library is broadly defined. Differentiation is made between *professional* libraries and *technical* libraries. Various aspects of professional libraries are discussed. The planning and building of a professional library is considered with emphasis on contents, sources, budget, storage, etc. A basic bibliography for a professional library in the field of optics is presented.

TRENDS IN PHOTO-OPTICAL EDUCATION

Open Forum Session

(concurrent with IMAGE PROCESSING session)

THURSDAY -- 9:00 - 12:00

STANDARDS TELEGRAPH HILL ROOM

Chairman: **Carl Nelson,** IBM, San Jose

AN EXPANSION OF THE EXPOSURE VALUE (EV) SYSTEM

W. F. Lindsey, NASA Langley Research Center

In research with carbon arc-jets, a need arose to transpose the experimentally determined correct exposure settings for one set of conditions to others with the same exceedingly high light levels of the jet. It appeared that the transpositions could be accomplished more rapidly and accurately if the EV system could be expanded both in extent and detail. How this was accomplished is explained.

STANDARDS IN PHOTOMETRY

Walter M. Clark, Northrop/Nortronics

Photometric measurements must be related to standards of reference to have any absolute significance. This paper describes the historical background of photometric standards and the prime and secondary devices and their relation to primary lamps from the National Bureau of Standards. The instrumentation and techniques used to perform the transfer of standards are described as well as the need for and use of these photometry standards.

SYMBOLS, UNITS AND NOMENCLATURE FOR ATMOSPHERIC TRANSMISSION

Irving J. Spiro, Aerospace Corp.
R. Clark Jones, Polaroid Corp.
David Q. Wark, U. S. Weather Bureau

This report discusses concepts, symbols, units and nomenclature for describing the transmission of radiant flux through earth's variable density atmosphere. The geometrical concepts used in the field of photometry and radiometry are the same. A common set of symbols is proposed for use in both fields together with some terms not previously used.

THE PHOTOGRAPHIC STANDARDS PROGRAM AT NBS

C. S. McCamy, National Bureau of Standards

NBS provides physical standards and calibration of standards as a basis for measurements. It cooperates with national and international standardizing organizations in the development of voluntary standard practices. These efforts must be supported by research in the science of measurement. NBS also provides scientific support for Federal Standards for films in the storage of records of permanent value. It is in the midst of an investigation of blemishes appearing on microfilm negatives.

About 25,000 microcopy resolution test charts are produced and sold and about 150 photographic step tablets are calibrated per year. A recommended practice for photographing specimens was written recently for ASTM. A 46-page standard photographic exposure guide was recently co-authored for ASA.

Current research is directed toward ASA standard methods of measuring the resolving power of photographic materials and revised methods of measuring optical density. A new principle of photometry resulted from the precise density measurement program and new terminology and notations have resulted from work on the revision of standard methods of measuring density.

LASER SAFETY STANDARDS

Norman A. Peppers, Optics Technology, Inc.

Today, a great many researchers, technicians, teachers, students and laymen are being exposed to radiation from lasers, the effects of which are only partly known. There can be dangers associated with the use of lasers, the greatest of which is the damage to ocular tissues by the intense optical radiation. Electrical, mechanical and optical hazards will be discussed and some thresholds for radiation damage to human tissues will be given. A brief account of some of the problems that must be solved before safety standards can be established will be given. Current safety procedures will also be discussed and recommendations made.

A PRACTICAL APPROACH TOWARD THE DETERMINATION OF RESOLUTION REQUIREMENTS

Jerrold Zimmerman, Radiation Center, Honeywell, Inc.

The utility and elegance of the Modulation Transfer Function (MTF) in photo-optical system design is well known. The difficulties involved in the measurement of this performance criteria, however, have restricted its practical application. The relationship between MTF and several more easily measured and specified resolution criteria, such as point- and line-spread functions, knife-edge response, and encircled energy, is developed. A method for specifying resolution criteria determined by MTF analysis for the optical designer and the evaluation laboratory is presented. The practicality of the method is enhanced by introducing certain simplifications to reduce the time required for computation.

MERIT NUMBERS IN MICROFILMING

Dr. Zyun Koana, University of Tokyo

Excellent microfilm negatives can be obtained at a reduction ratio 15 using well-corrected taking lenses with an f-number of 8. The product of the reduction ratio M (=15) multiplied by the denominator N (=8) of the aperture ratio 1:N, which is 120 in this case, will be called the *Merit Number*. If the merit number MN of any other microfilming process be the same *i.e.*, 120, the negatives will have the same quality. The quality of negatives will be superior (inferior) to the above case if the MN be smaller (larger) than 120. This proposition will be proved by the theory of diffraction of light at the aperture of the taking lens. Photographs of its experimental confirmation will be shown.

9:00 - 12:00 *(concurrent with STANDARDS session)*

IMAGE PROCESSING

GAS BUGGY ROOM

Chairman: **Dr. Thomas Skinner,** Technical Operations, Western Division

FOCUS RESTORATION

Kenneth Bernstein, Tech. Ops. Research

The problem of removing out-of-focus aberrations from a photographic image is examined. The futility of trying to remove aberrations by re-imaging through an out-of-focus system is explained. Hence spatial filtering techniques are required. A closed form analytic expression for the impulse response of the original system is derived and the transfer function is given as an auto-convolution integral. An interpretation of the auto-convolution kernel is given. The transfer function is displayed for the limits of both very small and very large focusing errors.

PROCESSING RANGER AND MARINER PHOTOGRAPHY

Fred Billingsley, Jet Propulsion Laboratory

A discussion of the *Lunar Television Image Converter* (Lunar-TIC) will be presented. This is the system utilized for the digital processing of the RANGER and MARINER pictures. Digitizing requirements and *tradeoffs* will be covered as they apply to this process which employs a magnetic analog tape as the data source, converts the data for processing in a 7094 computer and then converts it to picture form. Some of the RANGER and MARINER pictures which have been processed in the JPL digital computer will be shown and the various techniques used will be discussed. Samples will also be shown of the capability of Lunar-TIC to scan, digitize, and reconstruct photographic transparencies.

session continues next page

BLUR AND ITS EFFECT ON IMAGE QUALITY

H. M. A. El-Sum, Consulting Physicist

This paper will present a discussion of the blur theory leading to a prediction of the image quality of an object of any shape, formed by a classical image forming system. Using optical correlation techniques, an objective scale of measurement of such images has been established. This scale has unique features; one of which is that the reading on this scale at the threshold of recognition of all objects is the same. Projected slides will permit the audience to test the proposed scale.

SIZE-TUNED HYPERVELOCITY PARTICLE DETECTOR

Thomas J. Healey, Beckman & Whitley, Inc.

A basic scheme for detecting the passage of a hypervelocity particle through a particular region of space is to illuminate the region and focus it on a photocell with a telecentric lens. As the particle passes, the output of the photocell varies and this signal indicates the particle. This paper covers an important refinement which allows the detector to distinguish between one large particle and a swarm of small particles which scatter or reflect nearly as much light. It utilizes an optical analog of radar's *matched* filter to maximize the signal for particles of a preselected size. The theory of operation and the technique of realization of this filter will be presented.

OPTICAL IMAGE PROCESSING IN INCOHERENT AND COHERENT ILLUMINATION

Dr. Arwind Marathe, Tech. Ops., Western Div.

A brief review from a physical point of view of coherence theory and linear systems analysis as applied to optical systems used under coherent and incoherent conditions of illumination will be given. Image processing will then be looked upon as a problem of achieving a pre-specified optical transfer function for both cases of illumination separately. A conceptual solution to this problem will be given followed by a simple illustrative example.

IMAGE ENHANCEMENT THRU THE USE OF COHERENT LIGHT

David A. Ainsley, Conductronic Corp.

Coherent optical systems have the intrinsic property of easily obtaining the Fourier transformation of any given function that is recorded on photographic transparencies. This paper discusses techniques and equipment employed to manipulate and modify the Fourier transformation, thereby enhancing the image of the original function.

GAS BUGGY ROOM

2:00 - 6:00 *(concurrent with FILM PROCESSING session)*

LASERS

Chairman: **Dr. David Gregg,**
Livermore Radiation Laboratory

LOW VOLTAGE WIDEBAND ELECTRO OPTIC MODULATORS

Dr. James L. Hobart, Spectra-Physics, Inc.

Recent advances in electro-optic modulators now permit large modulation bandwidths at low driving voltages. Emphasis centers on three classes of devices: temperature compensated transverse Pockel's effect type; the multiple cell type using the longitudinal Pockel's effect; the room temperature paraelectric perovskites. The physical principles of these devices will be reviewed and the present state of their development summarized. The design of a multiple cell type modulator is discussed in some detail and the experimental performance described. Examples of the application of this device will be given.

ATMOSPHERIC PROBING WITH LIDAR

Frederick G. Fernald, Stanford Research Inst.

LIDAR (laser radar) offers a new method for remotely probing the atmosphere. "Clear air" targets such as invisible cirrus clouds and the boundaries of dust and haze layers in the lower atmosphere, as well as obvious targets such as visible clouds and smoke plumes, are readily detectable. Examples of both types of observations are presented with the emphasis on the "clear air" returns.

LASOGRAPHY - PHOTOGRAPHIC TECHNIQUES WITH COHERENT MONOCHROMATIC LIGHT

Matt Lehmann, Stanford University

The increasing availability of lasers as dependable sources of coherent monochromatic light has created a new field of photography. The techniques are so different from conventional photography, a new word, *Lasography*, has been coined. Slides or transparencies contain no recognizable images but still contain all the information necessary for precise optical reconstruction of the original object. Holograms contain both phase and amplitude information. Fourier transforms are expressions for the amplitude of two-dimensional spatial frequency. Conventional photographic techniques are inadequate. High resolution emulsions must be used for lasography. An analysis of the characteristic curves for these specially sensitized products give valuable information for exposure control and other aspects of lasography. Several procedures to improve quality and reliability for holography and Fourier transforms are the subject for final comment.

APPLICATIONS OF LASER BEAM SCANNING SYSTEMS EMPLOYING ULTRASONIC TECHNIQUES

Robert K. Erf, United Aircraft Research Labs.

The special properties of lasers have stimulated study of many types of laser beam scanning devices. Recent development of ultrasonic light scanning cells as laser beam deflectors suggests many new areas of application such as active optical imaging, high brightness CRT-type displays, acoustic angle sensing and beam steering, search and identification, pattern recognition and terrain clearance. Following a brief review of laser beam deflection theory (ultrasonically generated time-varying refractive-index gradient) a system will be described which provides a laser beam scan which can be electronically controlled and programmed at video rates. The system offers increased resolution, speed and accuracy relative to conventional microwave radar.

APPLICATION OF LASERS TO PHOTO-OPTICAL INSTRUMENTATION PROBLEMS

Robert L. Leighton, United Aircraft Corp.

A number of recent applications of lasers to the solution of photo-optical instrumentation problems are described. These include analytical and experimental studies performed to evaluate the use of a laser light source for a backscattering photometer to measure light transmission through the atmosphere, the application of a CW gas laser and a high-speed camera to investigate dynamic acoustic pressure waves and the use of both gas and solid state lasers as light sources for interferometer and schlieren systems.

ADVANTAGES AND PROBLEMS OF COHERENCE AS APPLIED TO PHOTOGRAPHIC SITUATIONS

Dr. Brian J. Thompson, Tech. Ops. Research

The advantages of narrow spectral width associated with high energy density make the use of lasers attractive for many conventional photographic situations. The effects of both spatial and time coherence on such photographic operations as contact printing, enlarging, etc., will be discussed. The use of coherent light allows a number of unconventional photographic applications to be pursued. The most popular of these presently is the hologram. Some comments on this and other applications will be included.

RESOLUTION LIMITATIONS OF LENSLESS PHOTOGRAPHY

Dr. Geo. B. Parrent, Jr. and Geo. O. Reynolds
Technical Operations Research, Inc.

The resolution requirements for imagery by hologram techniques are given. The case of folding in the reference beam at an angle is treated and the resolution is shown to depend both on the angle of the fold and the film used. In cases where magnification is obtained (*i.e.*, when spherical waves are used) it is shown that magnification is obtained only at the cost of resolution. The significance of these results on the field of lensless photography is discussed.

LASER SPOT SIZE IN DATA RECORDING

Samuel Bousky, Ampex Corp.

The CW gas laser provides a source combination of monochromaticity, high brightness and beam collimation useful in forming minute diffraction-limited spots for data recording or readout. How spot size, resolution and spatial frequency response is related to optical and physical system parameters is indicated.

ALIGNMENT AND DISTANCE MEASURING PROBLEMS

William Kunz, Watkins-Johnson
(tentative, no abstract submitted)

2:00 - 6:00 *(concurrent with LASERS session)*

FILM PROCESSING

TELEGRAPH HILL ROOM

Chairman: **Robert Mason,** Photomechanisms,

PERFORMANCE AND CURRENT APPLICATIONS OF THE BIMAT PROCESSING SYSTEM

Thomas G. Ferguson and Milton L. Schreiber, Eastman Kodak Company

The advantages and limitations of the Bimat processing system are discussed to aid the design of practical systems for its use. The presentation covers the Bimat system in a way intended to develop a better understanding of its true potential as well as its complexities and required supporting equipment so the design engineer can determine which new photographic systems may lend themselves to the use of Bimat.

SEPARATRON

Al Cronig, Houston Fearless Corp.

A newly developed, small, rapid-access, film processor employing the Gunter Schmidt principle is described. The machine is called the *Sepratron* and has the capability to process films with the processing fluids themselves as the film transporting medium. Special design criteria will be described.

A NEW FILM-MONOBATH COMBINATION FOR OSCILLOGRAPH

J. C. Barnes, W. J. Moretti, D. G. Bushman, Eastman Kodak Company

A film process is described which has use in oscillography applications where in-line processing at variable rates is desirable. A new film and a new monobath will be discussed which provide a capability to develop and clear in 30 seconds at 100° F.

PHOTOGRAPHIC STABILIZATION PROCESSING

John V. Baccoli, Jr., Ilford Inc.

This presentation, after a brief introduction devoted to the history of stabilization processing, considers some of the compromises which the technique imposes. The means for evaluating which systems may be employed for particular end products is suggested.

RAPID ACCESS HARD COPY FROM CRT DISPLAYS

Elliott P. Smith, Photomechanisms, Inc.

A rapid access hard-copy system is described in terms of its ultimate applications requirements and the deisgn criteria imposed. The means employed to solve the synchronisms required by system resolution will be covered.

PoroMat - A POROUS PLASTIC SATURATED WEB PROCESSING MATERIAL

Seymour Schreck, Fairchild Space & Def. Sys.

A microporous polyvinyl chloride sheet material impregnated with photographic processing solutions (*PoroMat*) is described. Applications are suggested. The sensitometry, resolution and modulation transfer, storage of saturated material, handling and storage of processed film, and the range of ambient conditions under which processing can be accomplished will be discussed.

RAPID ACCESS FILM PROCESSING AT TEN FEET PER MINUTE

John Taylor, HRB-Singer, Inc.

The evolution and development of two *moving window* displays and their integrated rapid access film processors is described and discussed in the context of the present status and future requirements for Multi-sensors Tactical Reconnaissance Systems.

(concurrent with MARKETS & MANAGEMENT session)

FRIDAY -- 9:00 - 12:00

DATA REDUCTION

GAS BUGGY ROOM

Chairman: **George A. Michael,**
Livermore Radiation Laboratory

INTRODUCTION: **Dr. Harold Kasnitz,** MIT

CONTROL AND MEASUREMENT OF DISCRETE DENSITY LEVELS ON FACTOR DENSITY TRANSPARENCIES

H. G. Franke, Aero Service Corp., Div. of Litton Industries

A photographic system has been designed for the storage of information on photographic plates in the form of discrete density levels. Source data is compiled and assembled to yield separated high contract records on 48 by 52 in. glass. These high contrast records are sequentially reduced to extreme dimensional accuracies to give a series of printing masks, which are in turn used to expose a final composite plated by intermittent sensitometry.

PHOTOGRAPHIC MASS MEMORY SYSTEMS

Robt. J. Entwistle, USN Training Dev.Center

Photographic mass memory devices having an information storage capacity of 2×10^8 bits per sq. in. are discussed. The manufacturing method for one application, special micro sensitometry, and resolution evaluation is detailed. Research leading to increased information capacity is further outlined.

NEW METHODS OF PRESENTING COMPUTER OUTPUT USING COLOR, MOTION & STEREO

George A. Michael, Livermore Radiation Lab.

The application of fast digital computers to appropriate problems in pure and applied science is profoundly altering both the scope and attitudes of the persons using these machines. New insights into the ways of modeling physical phenomena are being achieved with the help of graphical representation of results. A series of computer generated, motion sequences are presented as examples of this type of work, along with a description of the equipment presently available for producing such examples. Design criteria are suggested for developing future peripheral equipment for use with digital computers.

DATA EXTRACTION FROM AERIAL PHOTOGRAPHS BY HUMAN AND MECHANICAL MEANS

Dr. Robt. N. Colwell, University of California

Until recently the extraction of data from aerial photographs was performed primarily through the joint efforts of two classes of highly skilled personnel -- photogrammetrists and photo interpreters. While the tasks which they performed on photographic images were somewhat overlapping, it was generally agreed that the photo interpreters identified objects and the photogrammetrists made measurements and constructed maps from the photographs. With the advent of automation certain reputable scientists who have analyzed the various facets of data extraction from aerial photographs have concluded that, in this area as in many others, the machine will soon replace the human. This paper seeks to analyze the validity of that assertion.

A NEW COMPUTER ORIENTED MICRODENSITOMETERS

Albert J. Derr, General Aniline & Film Corp.
(tentative, no abstract submitted)

TELEGRAPH HILL ROOM

9:00 - 12:00 *(concurrent with DATA REDUCTION session)*

MARKETS AND MANAGEMENT

Chairman: **William B. Sullivan,**
Houston Fearless Corp.

NEW PRODUCT DEVELOPMENT FROM A RESEARCH PROJECT

Richard L. Villoria, Houston Fearless Corp.

The transformation of a hardware research and development project to a production program which meets the lead time and cost demands of the market can be a complex problem requiring rigorous coordination between engineering, production and the marketing function. How this transition was accomplished in the successful introduction and marketing of the Variscan, an advanced photointerpretation tool is described. To meet market demands, the product was guided into full scale production while the basic engineering design task was still in progress.

SBA's SERVICES TO SMALL BUSINESS

Ray Wallace, Small Business Administration

Emphasis will be placed on the various ways the Small Business Administration can help the Independent Instrumentation firm with its' marketing and management problems.

WHAT THE MILITARY NEEDS - ARMY'S PROCUREMENT PLANNING FOR THE NEXT SIX YEARS

Col. Dwight W. Langham, Fort Mason, Calif.

The reorganized logistical structure of the Army has charged the five Commodity Commands of Army Materiel Command - Electronics, Missile, Mobility, Munitions, and Weapons with procurement development, build-up, and maintenance of the hardware to equip a United States Army that is "ready upon call." This requires close coordination with industry if our joint effort is to furnish the quantity and quality equipment necessary at a dollar cost that our economy can afford. Further, to secure closer industry support and to keep both government and industry informed as early as possible, the Army has conducted a pilot test of giving industry a look into the future on planned requirements through the release of Advanced Planning Procurement Information. The results of this test conducted under the Deputy Commanding General, AMC for Western Operations, is outlined and evaluated.

MANAGEMENT'S VIEW OF MARKETING

Robert L. Abbott, F.M.A., Inc.

With regard to certain aspects of selling to the Department of Defense, it is not possible for Management to view its marketing activities in the same light as a consumer product oriented Management would view its marketing activities. The DOD marketing man is not solely a high-pressure salesman with a quota to fill -- he has many other jobs to do to insure that his company is fairly and truly represented in the DOD marketplace. Mental conditioning to this peculiar type of activity that is essential both on the part of the man in the field and his Management is discussed.

VALUE ENGINEERING

Donald S. Clark, North American Aviation

This talk deals with the importance of Value Engineering in the engineering department. It highlights the necessity for simplicity of design to ensure maximum performance of the end product. It also emphasizes the factors involved in schedules and costs, which are of basic importance to both the Company and the Customer.

1:30 - 5:00 GAS BUGGY ROOM

AEROSPACE INSTRUMENTATION

Chairman: **Malcolm Malcolmson,** Mark Systems

THE DETECTION OF MARTIAN LIFE BY REMOTE PHOTOGRAPHIC SENSING

S. Levine, Mark Systems

The presentation will explore the background of the Mars life controversy, survey current efforts in techniques for the detection of Martian life forms by remote sensing and discuss the contribution, a high resolution, spectrozonal comparative photographic imaging system may make in resolving this enigma. A system concept will be presented and mechanization discussed thus making an attempt to bridge the all important and often overlooked transition from pure analytical studies to practical hardware designs.

A PHOTOGRAPHIC MEASURING SYSTEM FOR THE DETERMINATION OF SATELLITE AND SUB-SATELLITE VEHICLE ATTITUDE

F. Ching, Mark Systems

A photogrammetric instrumentation system is described which is capable of being (and has been) employed at altitudes over 100 miles as the primary means for accurately determining the capability of achieving proper vehicle attitude orientation. A brief discussion of the data reduction and analysis program is provided, explaining the mathematical model, the photo interpretation aspects, and the statistical analysis of computer calculated data.

LIQUID SPACE OPTICS

John H. Bloomer, Space Optics Consultant

Optical elements may be separated into two classes: (1) Solid Optics, and (2) Membrane Optics. Solid optical elements - such as glass or plastic lenses and glass or metal mirrors - possess initially rough surfaces due to crystalline structure. Grinding and polishing reduces these surfaces to an amorphous atomic condition similar to that of liquid surfaces. Membrane optical elements - such as the cornea of the human eye, the Wood rotating mercury paraboloid, the IRCO electrostatically-figured membrane paraboloid and the "Orbiting Eye" - possess initially smooth and symmetric surfaces. The aspects involved in the development of this "Eye" is discussed by its inventor.

INTERPLANETARY PHOTOGRAPHY WITH THE SLOW-SCAN VIDICON

L. R. Malling, Jet Propulsion Lab.

The Mariner-Mars TV camera forms part of a limited weight and powered multi-purpose scientific instrumentation complex. The function of the camera is to translate photometric and spectral information into a digital format suitable for planetary range transmission to earth. Inputs to the camera arise from the planetary surface, the outer space environment, the spacecraft and communications with earth. A slow-scan electrostatic vidicon is used as the imaging device and must survive a rocket launch and a space voyage of several months. An extremely high-impedance silicon-compound, semi-conductor photo surface was developed to meet the desired photometric characteristics in addition to other desired features essential for slow-scan vidicon operation.

A REVIEW OF THE LUNAR SURFACE PROPERTIES RESULTING FROM RANGER FLIGHT RESULTS

Donald D. Willingham, Jet Propulsion Lab.

A review of the concepts of the lunar topography prior to the flight of the Ranger series will be given. The original mission objective and the increased knowledge of the surface provided by the Ranger Missions will be outlined. Data reduction and analysis methods presently being employed will be indicated and the characteristics of the cameras will be briefly described.

EXHIBORAMA of INSTRUMENTS

The S.P.I.E. Symposium Product Display is an important adjunct to the papers program. The concientious worker will find a source of valuable applications information at the same time he is introduced to the most recently developed *"tools of the trade"*.

The exhibitors have staffed their booths with Technical Representatives and Application Engineers who are prepared to discuss the capabilities and limitations of their products in terms of instrumentation problems similar to those which may confront you. You are invited to consult with them freely...and often.

We will look for you there, not as a *"tire kicker"*, but as a potential *"user"*. We can then discuss photo-optical instrumentation in an atmosphere of mutual inquiry.

The exhibit hours are easy to remember: noon until eight o'clock each day except the first and last. On the first day, Monday, the exhibit area will open right after the Keynote Luncheon, about two-thirty. On Friday, the last day, the exhibits will be open from nine until noon.

Robert Kotula
Joe Y. Saunders
Exhibitors Committee

EXHIBITS

Arriflex Corporation of America Booth 33
826 North Cole, Hollywood, Calif.

Exhibiting: Arriflex motion picture cameras, Simmons Projectors.

Personnel: Michael Zois, Allen Gamson, Abbott Sydney

Beckman & Whitley, Inc. Booths 28-29
Subsidiary of Technical Operations, Inc.
993 East San Carlos Ave.
San Carlos, Calif. 94070

Exhibiting: Biplanar Image Converter Cameras, Model 200 Simultaneous Streak & Framing Camera, Isodensitracer.

Personnel: Myron B. Baldwin, Jack M. Patterson, Thomas J. Healey, Eugene R. Peterson

Eastman Kodak Company Booth 36
Instrumentation Products Division
Rochester, New York

Exhibiting: Kodak RAR Films, ER & MS Films, Direct Print Papers, Monobath Processing

Personnel: A. C. Thomsen, Director; A. E. McCoy, J. White, D. Woods, T. Fleischman, R. Schaller, J. Sonnendecker, A. Sullivan

Ehrenreich Photo Optical Industries, Inc.
623 Stewart Avenue Booths 47-48
Garden City, N.Y. 11533

Exhibiting: Nikon-Durst-Mamiya

Personnel: Edw. C. Brodnicki, Ralph Holbert, Stewart Held

Carlos H. Elmer Booths 12-13
Box 875, Scottsdale, Arizona

Exhibiting: Data Recording Cameras, Film Viewers and Readers, Accessories.

Personnel: Carlos H. Elmer

Ansco Photo Products Booths 25-26
General Aniline & Film Corp.
140 W. 51st St., New York, N.Y. 10020

Exhibiting: GAF Recording Microdensitometers, Anscotrace, Colortrace and Linatrace Photo recording papers, GAF Microline Evaluator and Micro-Image Scanner

Personnel: Harold Jones, Dave Fuchs, Emmett Gumm, A. J. Derr, G. J. Giuffre, F. M. Flynn

General Precision, Inc., Link Group Booth 27
Binghamton, N.Y.; Palo Alto, Calif.

Exhibiting: V-Angle Reader, Ballistic Camera Synchronization System; Photogrammetric Systems.

Personnel: T. T. Harding, J. D. Savidge, J. W. Scales, J. H. Mellard, J. T. Nelson, R. A. Lyons, R. P. Stanton

Giannini Scientific Corp. Booth 14
Richmond Division
P.O. Box 1-F, Richmond, Virginia 23201

Exhibiting: Model 705 High Speed Intermittent 300 fps motion picture camera; Automatic Exposure Control; Model 207 and IV Multi-data® pulse and cine cameras.

Personnel: R. Woltz, W. K. Glave, P. Turchi, A. Phillips.

Karl Heitz, Inc. Booth 43
979 Third Ave., New York, N.Y. 10022

Exhibiting: ALPA Swiss 35 single-lens reflex cameras with electronically compensated behind-the-lens CdS meter; ROBOT 35mm auto-sequence cameras and electro-automatic recording systems; KINOPTIK APOCHROMATS for movie, TV, still cameras and instruments; 16, 35mm and larger size.

Personnel: Yvonne Brandes, Asst. Sales Mgr.; Charles House

Helicopter Camera Systems Booth11
6335 Homewood Ave., Hollywood, Calif.

Exhibiting: Helicopter Camera Systems.

Personnel: A. C. Bass, Wayne Yentis, Nelson Tyler, Peter K. Pascal

L-W Photo, Inc. Booth 5
15451 Cabrito Rd., Van Nuys, Calif.

Exhibiting: Flickerless Stop-Motion Projectors

Personnel: Bob Lawrence, Geoff Williamson

McDonnell Aircraft Corp. Booth 19
P. O. Box 516, St. Louis, Mo. 63166

Exhibiting: Direct Radar Recorders, Space Cameras, High Speed Pin Reg. Cameras.

Personnel: S. R. Colletti, D. Clay, S. B. Arnold, B. L. McArdle

3M Company, Photographic Equipment & Optical Division Booth 23
850 Hudson Ave., Rochester, N.Y. 14621

Exhibiting: Full line of Wollensak-Fastax High Speed Cameras and related accessories. Mirrotel radar boresights and other photo instrumentation equipment

Personnel: Fred M. Emens, C. J. Wade, Sr., T. Bowman.

D. B. Milliken Co. Booths 15-16
131 No. Fifth Ave., Arcadia, Calif. 91006

Exhibiting: DBM-64 Kinescope Recording Camera; Winter Mounts & Lens Supports; Richter Autocollimator System; DBM-25 High "G" Camera; DBM-5C w/Automatic Exposure Control; DBM-4D, DBM-3, DBM-10.

Personnel: C. G. Holzapfel, Glen A. Crandall, R. C. Kiteley, Lou Meyer, J. R. Hereford

Northridge Research Inc. Booth 41
18222 Parthenia St., Northridge, Calif. 91324

Exhibiting: 16 mm and 35 mm Cameras and associated equipment.

Personnel: Dennis Robinson, Chas. Lotspeich

Optics Technology Inc. Booth 35
901 California Ave., Palo Alto, Calif.

Exhibiting: Automatic lens Modulation Transfer Function Analyzer; High Peak Power Q-Switched Laser; Ultra Fast Detector; Interference Filters - Ultraviolet, Visible and Infrared Continuous Gas Laser; Fiber Optics and other electro-optical instrumentation.

Personnel: T. J. Perkins, R. A. Jaenicke, R. Gray

Photo-Kinetics, Inc. Booth 17
1624 Stillwell Ave., Bronx, N.Y. 10461

Exhibiting: NOVA 16mm High Speed Motion Analysis Cameras.

Personnel: A. Ippolito

Professional Color Laboratory Booth 8
45 Ecker St., San Francisco, Calif.
and
Adolph Gasser Inc.
5733 Geary Blvd., San Francisco, Calif.

Exhibiting: Photographic Color Processing, Color Services and Photographic Equipment.

Personnel: Arno, Cora and Mike Parik, Adolph Gasser, Dieter Grabitsky, John Gasser, Dave Lomasney.

Quick-Set, Inc. Booths 37-38
8121 Central Park, Skokie, Ill.

Exhibiting: Super Quick-Set, Samson, Hercules, Gibraltar, a complete line of tripods, pedestals, pan heads, console units, dollies, etc. for photo, television, remote control, high-speed or instrumentation usage.

Personnel: A. J. Briglia

The Rolor Corporation Booth 24
11050 Washington Blvd., Culver City, Calif.

Exhibiting: The Rolor Transflo 1205, Automatic Film/Paper Processor.

Personnel: William Bontrop

Red Lake Laboratories Booth 1
2971 Corvin Dr., Santa Clara, Calif. 95051

Exhibiting: HYCAM and Accessories; A complete line of 16mm High Speed Motion Picture Cameras and Accessories.

Personnel: Robert D. Shoberg, Joe Y. Saunders, Donald Southard, Ernest M. Whitley, C. Glen Williamson, Al Soria, Elmer Larsen

Spectra-Physics, Inc. Booth 18
1255 Terra Bella Ave., Mountain View, Calif.

Exhibiting: CW Lasers and Laser Ranging Systems.

Personnel: Eugene L. Watson, Richard Stark, Robert Mortensen

Zoomar, Inc. Booth 50
55 Sea Cliff, Glen Cove, L.I., New York
1586 Crossroads of the World, Hollywood, Calif.

Exhibiting: ITV Tracking Zoomar; ITV Zoomar Lenses (Mark X-B and Mark XX) remote control; Instrument for Automatic High Reduction Microphotography; and Reflectar Optics.

Personnel: Dr. Frank G. Back, Miss Claire Redman, Miss Marian Sheppard

Cinema Beaulieu Booth 42
921 Westwood Blvd., Los Angeles, Calif. 90024

Exhibiting: RC 16E Electric Cameras; R 16E Sync-electric Camera; MAR 8G and MCR 8G Cameras; Angenieux Lenses

Personnel; M. Gould, H. Mazur, J. Tannen.

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